A comparative survey of mangrove dynamics in India, Sri Lanka, Malaysia and Kenya

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In terms of geographical distribution of the mangrove forests, the South and Southeast Asian countries are supporting not only an extensive cover (51,800km^2), but also a rich species diversity (17-40) (UNEP, 2014). While Malaysia remains as the second largest mangrove nation (5,800km^2) next to Indonesia (31,890km^2), India occupied the fifth position (3,682km^2) (Spaldings *et al*., 2010). Though Sri Lanka is small by the country itself, the island-wide estuarine/lagoon areas are still supporting some luxuriant mangroves (89km^2 with 20 species) that claimed to be (almost) stable for the last 20-30 years (UNEP, 2014). On the other hand, the mangrove cover in Africa (32,428km^2 with 11-20 species) stands next to the Asian continent. The present paper compares the mangrove vegetation dynamics (together with local conservation/management practices) observed from Coringa wildlife Sanctuary in India (Satyanarayana *et al*., 2009), Galle-Unawatuna area in Sri Lanka (Satyanarayana *et al*., 2011a, 2013), Tumpat mangroves in Malaysia (Satyanarayana *et al*., 2010, 2011b), and Gazi Bay in Kenya (Satyanarayana *et al*., unpublished results). In the case of Coringa, the mangroves were comprised of 15 species. *Avicennia marina* was the most important species contributing 43% of the total basal area (mean density, 123 trees 0.1ha^{-1}) (max. height 12m), followed by *A. officinalis* (39%) (25 trees 0.1ha^{-1}) (11.3m) and *Excoecaria agallocha* (12%) (72 trees 0.1ha^{-1}) (7.1m). All other species in the vicinity represented only ≤6% of the total wood volume on the ground (6-52 trees 0.1ha^{-1}). The mangrove composition at Galle-Unawatuna is characterized by 10 species of which *Rhizophora apiculata* was abundant (42% contribution to total basal area) (186 trees 0.1ha^{-1}) (8.7m), while *E. agallocha* (22%) (73 trees 0.1ha^{-1}) (6.5m) and *Bruguiera gymnorrhiza* (21%) (79 trees 0.1ha^{-1}) (6.8m) are next in the order. At Tumpat, though *Nypa fruticans* and *Sonneratia caseolaris* were widely distributed among the five dominant taxa, only *S. caseolaris* (46 trees 0.1ha^{-1}) (15m) and *A. alba* (67 trees 0.1ha^{-1}) (12m) are accountable for 95% of the total basal area. At Gazi Bay, the habitat recovery of the (*Ceriops tagal*) reforested mangrove sites was assessed in relation to the natural sites. In this context, a combination of results indicating site selection/location, tree growth/foliage, fauna and its competition, etc., were all found important. The distribution of mangroves at Coringa and Tumpat also revealed several species-level associations whereas species' turnover in relation to the physical infrastructure developments was witnessed from Galle-Unawatuna. Besides the traditional fishing in mangrove areas, the other manmade activities such as tree felling, timber collection, forest clearing for aquaculture and agriculture, etc., are strictly prohibited in both India and Sri Lanka. On the other hand, sustainable use of the forest resources has been a priority of the Malaysian mangrove managers. In this context, the silvicultural management based on 30-year rotation and its regular exploitation for commercial (pole/charcoal) as well as non-commercial (food/shelter) purposes is benefiting several local people and their livelihoods (Quispe Zuniga, 2014). Viewing the importance of mangroves to local communities, its sustainable utilization patterns should be legitimated rather than imposing a complete ban. The local people given with appropriate share of revenue and responsibilities would be able to protect the mangrove ecosystems better than any law and order alone which can be also evidenced practically in Malaysia.

References

Quispe Zuniga M.R. 2014. Mangroves fuelling livelihoods: A socio-ecological assessment and stakeholder analysis of fuelwood production and trade in Matang Mangrove Forest Reserve, Peninsular Malaysia. M.Sc. Thesis, Vrije Universiteit Brussel (VUB), Belgium, 198 pp.

Satyanarayana B., A.V. Raman, H. Mohd-Lokman, F. Dehairs, V.S. Sharma and F. Dahdouh-Guebas. 2009. Multivariate methods distinguishing mangrove community structure of Coringa in the Godavari Delta, East coast of India. Aquatic Ecosystem Health & Management 12:401-408.

Satyanarayana B., I.F. Idris, K.A. Mohamad, H. Mohd-Lokman, N.A.M. Shazili and F. Dahdouh-Guebas. 2010. Mangrove species distribution and abundance in relation to local environmental settings: a case-study at Tumpat, Kelantan Delta, East coast of Peninsular Malaysia. Botanica Marina 53:79-88.

Satyanarayana B., N. Koedam, K. De Smet, D. Di Nitto, M. Bauwens, L.P. Jayatissa, S. Cannicci and F. Dahdouh-Guebas. 2011a. Long-term mangrove forest development in Sri Lanka: early predictions evaluated against outcomes using VHR remote sensing and VHR ground-truth data. Marine Ecology Progress Series 443:51-63.

Satyanarayana B., K.A. Mohamad, I.F. Idris, H. Mohd-Lokman and F. Dahdouh-Guebas. 2011b. Assessment of mangrove vegetation based on remote sensing and ground-truth measurements at Tumpat, Kelantan Delta, East coast of Peninsular Malaysia. International Journal of Remote Sensing 32:1635-1650.

Satyanarayana B., S. Mulder, L.P. Jayatissa and F. Dahdouh-Guebas. 2013. Are the mangroves in the Galle-Unawatuna area (Sri Lanka) at risk? A social-ecological approach involving local stakeholders for a better conservation policy. Ocean and Coastal Management 71:225-237.

Satyanarayana B., B. Pecceu, T. Van der Stocken, D. Di Nitto, K. Van Den Bossche, J.O. Bosire, S. Cannicci, H. Mohd-Lokman, N. Koedam and F. Dahdouh-Guebas. (unpublished results). Habitat recovery assessment of reforested mangrove sites in the Gazi Bay, Kenya: a study testing the role of molluscs as bioindicator species.

Spalding M., M. Kainuma and L. Collins. 2010. World atlas of mangroves. A collaborative project of ITTO, ISME, FAO, UNEP-WCMC, UNESCO-MAB, UNU-INWEH and TNC, Earthscan, London. 319 pp.

UNEP. 2014. The importance of mangroves to people: A call for action. van Bochove J., E. Sullivan and T. Nakamura (Eds). United Nations Environment Programme (UNEP) World Conservation Monitoring Centre, Cambridge. 93 pp.